(weight percent based on the total weight of the composite material) of filler is kept constant at 84 wt% while the composition of the filler is varied. In Example 9 Asbury A99 is used exclusively.

The conductive moldable composite material as well as articles made from it are economical to produce due to the inexpensive starting materials as well as the use of conventional processing equipment.

While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitations.

What is claimed is:

1. A composite material for the manufacture of electrochemical cell components comprising:

a thermosetting resin system and conductive filler wherein the thermosetting resin system comprises a polybutadiene or polyisoprene resin and the composite material has a volume resistivity of about 0.116 ohm-cm or less.

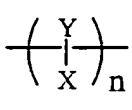
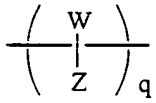
2. The thermosetting resin system of Claim 1 further comprising an unsaturated butadiene- or isoprene-containing polymer, wherein the volume to volume ratio of the polybutadiene or polyisoprene resin to the unsaturated butadiene- or isoprene-containing polymer is between 1:9 and 9:1, inclusive.

3. The thermosetting resin system of Claim 2 wherein the unsaturated butadiene- or isoprene-containing polymer is a copolymer of isoprene or butadiene and a second monomer.

4. The thermosetting resin system of Claim 3 wherein the unsaturated butadiene- or isoprene-containing polymer is a di-block copolymer.

5. The thermosetting resin system of Claim 4 wherein the unsaturated butadiene- or isoprene-containing polymer is a styrene-butadiene or α-methyl styrene-butadiene di-block copolymer.

6. The thermosetting resin system of Claim 3 wherein the unsaturated butadiene- or isoprene-containing polymer is a thermoplastic elastomer block copolymer having one of the formula

$X_m(Y\text{-}X)_n$,  , $W_p(Z\text{-}W)_q$, or 

where in each formula Y is a block comprising isoprene or butadiene units, X is a thermoplastic block, and m and n represent the average block numbers in said copolymer, m being 0 or 1 and n being at least 1; and Z is a polyethylene or ethylene-propylene copolymer block, W is a thermoplastic block, and p and q represent the average block numbers in said copolymer, p being 0 or 1 and q being at least 1.

7. The thermosetting resin system of Claim 2 wherein the unsaturated butadiene- or isoprene-containing copolymer is liquid.

8. The thermosetting resin system of Claim 2 wherein the unsaturated butadiene- or isoprene-containing copolymer is solid.

9. The composite material of Claim 1 wherein the conductive filler is synthetic graphite.

10. The thermosetting resin system of Claim 1 further comprising a curing agent.

11. The thermosetting resin system of Claim 10 wherein the curing agent is an organic peroxide.

12. The thermosetting resin system of Claim 11 wherein the curing agent is selected from the group consisting of dicumyl peroxide, di(2-tert-butylperoxyisopropyl) benzene, t-butylperbenzoate, 2,5-dimethyl-2,5-di(t-butyl peroxy) hexyne-3, and combinations thereof.

13. The thermosetting resin system of Claim 1 wherein the polybutadiene or polyisoprene resin is liquid and has a molecular weight of less than 5,000.

14. The thermosetting resin system of Claim 1 wherein the polybutadiene or polyisoprene resin is liquid and has a molecular weight of about 1,000 to about 3,000.

15. The thermosetting resin system of Claim 1 further comprising a functionalized liquid polybutadiene or polyisoprene resin.

16. The thermosetting resin system of Claim 1 further comprising a low molecular weight polymer resin.

17. The thermosetting resin system of Claim 1 further comprising at least one monomer with vinyl unsaturation.

18. The thermosetting resin system of Claim 17 wherein the at least one monomer with vinyl unsaturation is selected from the group consisting of styrene, vinyl toluene, divinyl benzene, triallylcyanurate, diallylphthalate, and multifunctional acrylate monomers.

19. The composite material of Claim 1, wherein the composite material comprises, based on the total material, about 10 to about 90 volume percent of the conductive filler.

20. The composite material of Claim 1, wherein all or part of the conductive filler is in the form of fibers, platelets, or a combination of fibers and platelets.

21. The composite material of Claim 1, wherein the composite material has a volume resistivity of about 0.08 ohm-cm or less.

22. The composite material of Claim 21, wherein the composite material has a volume resistivity of about 0.04 ohm-cm or less.

23. The composite material of Claim 1, wherein the composite material has a thermal conductivity of at least about 5 watts/meter °K.

24. The composite material of Claim 23, wherein the composite material has a thermal conductivity of at least about 7 watts/meter °K.

25. The composite material of Claim 24, wherein the composite material has a thermal conductivity of at least about 9 watts/meter °K.

26. An article molded from the composite material of Claim 1, wherein the article has a linear shrinkage per unit length of the molded composite in the X-Y plane of less than or equal to about 0.005.

27. The article of Claim 26, wherein the linear shrinkage per unit length of the molded composite in the X-Y plane is less than or equal to about 0.003.

28. The article of Claim 27, wherein the linear shrinkage per unit length of the molded composite in the X-Y plane is less than or equal to 0.001.

29. A composite material for the manufacture of electrochemical cell components comprising:

a thermosetting resin system and about 10 vol% to about 90 vol% of conductive filler, based on the total material, wherein the thermosetting resin composition comprises a polybutadiene or polyisoprene resin.

30. A method of making a composite material for the manufacture of electrochemical cell components comprising:

making a dilute solution of a thermosetting resin system comprising polybutadiene or polyisoprene resin in a volatile solvent;

slowly adding the dilute solution to a conductive filler; and

mixing to form a homogenous solution.

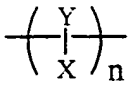
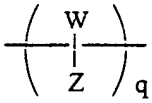
31. The method of Claim 30 wherein the thermosetting resin system further comprises an unsaturated butadiene- or isoprene-containing polymer capable of participating in cross-linking with the polybutadiene or polyisoprene resin during cure, and further wherein the volume to volume ratio of the polybutadiene or polyisoprene resin to the unsaturated butadiene- or isoprene-containing polymer is between 1:9 and 9:1, inclusive.

32. The method of Claim 31 wherein the unsaturated butadiene- or isoprene-containing polymer is a copolymer of isoprene or butadiene and a second monomer.

33. The method of Claim 32 wherein the unsaturated butadiene- or isoprene-containing polymer is a di-block copolymer.

34. The method of Claim 33 wherein the unsaturated butadiene- or isoprene-containing polymer is a styrene-butadiene or α-methyl styrene-butadiene di-block copolymer.

36. The method of Claim 32 wherein the unsaturated butadiene- or isoprene-containing polymer is a thermoplastic elastomer block copolymer having one of the formula

$X_m(Y\text{-}X)_n$,  , $W_p(Z\text{-}W)_q$, or 

wherein each formula Y is a block comprising isoprene or butadiene units, X is a thermoplastic block, and m and n represent the average block numbers in said copolymer, m being 0 or 1 and n being at least 1; and Z is a polyethylene or ethylene-propylene copolymer block, W is a thermoplastic block, and p and q represent the average block numbers in said copolymer, p being 0 or 1 and q being at least 1.

36. The method of Claim 31 wherein the unsaturated butadiene- or isoprene-containing copolymer is liquid.

37. The method of Claim 31 wherein the unsaturated butadiene- or isoprene-containing copolymer is solid.

38. The method of Claim 30 wherein the conductive filler is synthetic graphite.

39. The method of Claim 30 wherein the thermosetting resin system further comprises a curing agent.

40. The method of Claim 39 wherein the curing agent is an organic peroxide.

41. The method of Claim 40 wherein the curing agent is selected from the group consisting of dicumyl peroxide, di(2-tert-butylperoxyisopropyl) benzene, t-butylperbenzoate, 2,5-dimethyl-2,5-di(t-butyl peroxy) hexyne-3, and combinations thereof.

42. The method of Claim 30 wherein the polybutadiene or polyisoprene resin has a molecular weight of less than 5,000.

43. The method of Claim 30 wherein the polybutadiene or polyisoprene resin has a molecular weight of about 1,000 to about 3,000.

44. The method of Claim 30 wherein the thermosetting resin system further comprises a functionalized liquid polybutadiene or polyisoprene resin.

45. The method of Claim 30 wherein the thermosetting resin system further comprises at least one monomer with vinyl unsaturation.

46. The method of Claim 45 wherein the at least one monomer with vinyl unsaturation is selected from the group consisting of styrene, vinyl toluene, divinyl benzene, triallylcyanurate, diallylphthalate, and multifunctional acrylate monomers.

47. The method of Claim 30, wherein the composite material comprises, based on the total material, about 10 vol% to about 90 vol% of the conductive filler.

48. A conductive composite material comprising a thermosetting resin system and conductive filler, wherein the thermosetting resin system comprises a polybutadiene or polyisoprene resin, and further wherein the composite material is formed into an electrochemical cell component having a volume resistivity of 0.116 ohm-cm or less.

49. A conductive composite material comprising, based on the total material, a thermosetting resin system and about 10 to about 90 volume conductive filler, wherein the thermosetting resin system comprises a polybutadiene or polyisoprene resin and the conductive composite material is formed into an electrochemical cell component.

50. A bipolar plate formed from the composition of claim 1.